Swelling Properties of Various Polymers Used in Controlled Release Systems

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Abstract

The effect of powder packing and porosity of specimens on the swelling properties of polymeric materials was studied, in various swelling liquids, such as distilled water and 0.1 N hydrochloric acid solution. Capsules, tablets and films of hydroxypropyl methylcellulose, poly(ethylene oxide) and sodium alginate were prepared and their weight uptake after immersion into the above solutions was recorded as a function of time, in order to assess the swelling process. Measurements of some characteristics of the as received powders were also performed as an attempt to classify the specimens prepared according to their porosity. Within the experimental conditions of this work, it was shown that the porosity of polymeric specimens is a dominant factor that controls their swelling behaviour. Increased porosity leads to fast initial rates of weight uptake and high extent of equilibrium swelling. On the other hand, dissolution and possible degradation of polymers susceptible to acid hydrolysis, results in some variations from the above-mentioned behaviour. With respect to the application in controlled release systems, the overall delivery rate from a polymeric specimen is expected to be a function of both swelling and disintegration characteristics of a specimen and, therefore, the weight uptake can be considered a measure of the release only in the case of polymers with low water solubility and increased stability to hydrolysis.